In the Specification

Kindly replace paragraph [0001] with the following:

TECHNICAL FIELD

~~The present invention~~ This disclosure relates to a biaxially oriented thermoplastic resin film having significantly improved quality. In particular, it relates to a biaxially oriented thermoplastic resin film which has excellent heat resistance, thermal dimensional stability, and mechanical properties and which is a film suitable for various industrial materials, for example, magnetic recording media, circuit materials, capacitors, thermal transfer ribbons, and cards.

Kindly replace paragraph [0002] with the following:

BACKGROUND ~~ART~~

Plastic films are used in areas of magnetic recording, agriculture, packaging, building materials, and the like, in which demand is great, because of advantages in properties, e.g., the strength, the durability, the transparency, the flexibility, and impartation of surface properties. Most of all, biaxially oriented polyester films are used in various areas because of excellent mechanical properties, thermal properties, electrical properties, and chemical resistance. In particular, the usefulness for magnetic recording media is far ahead of other films. However, the dimensional stability and the heat resistance of the polyester film are inadequate depending on uses and, therefore, there is a limitation of application to various industrial material films. For example, in themagnetic recording medium sue, reduction in thickness and higher density recording are pursued for minaturizatin and long-duration recording, and requirements for higher strength and improvement of form stability and thermal dimensional stability in a use environment of a base film have become even more intensified. In the circuit material use and the like, requirements for films having highly balanced heat resistance, thermal dimensional

stability, mechanical strength, chemical resistance, and the like have been intensified in accordance with the needs for miniaturization and more functionality in electrical and electronic areas.

Kindly replace paragraph [0003] with the following:

~~Researches were~~ Research was previously conducted on methods in which polyesters were allowed to contain particles and, thereby, fibers and resin moldings were allowed to have high strength. As a result, a method in which fibers have been allowed to contain metal oxide fine particles having particle diameters of 100 nm or less and, thereby, the strength and the dimensional stability of the fibers have been improved (Japanese Unexamined Patent Application Publication No. 1-192820), a method in which a metal complex coordinated with glycols has been added to a polyester-based resin by polymerixation, the metal has been reduced to an element, and fine particles of a metal, e.g., palladium, have been finely dispersed into a polymer so as to allow a resin molding to have a high modulus of elasticity (Japanese Unexamined Patent Application Publication No. 10-298409), and the like have been proposed. However, there is no example in which these technologies are applied to films and, in contrast to the present invention, it was not an object to raise the melting point of the film, and to improve the heat resistance and the thermal dimensional stability of the film.

Kindly replace paragraph[0004] with the following:

~~Researches were~~ Research was conducted on methods in which biaxially oriented polyester films were allowed to contain particles. Examples of methods include a method in which particles having particle diameters of less than 300 nm of oxides of fifth and sixth period elements in the periodic table of elements (Japanese Unexamined Patent Application Publication No. 3-115437 and the like) are contained in a film. It is a primary object of ~~these~~ those proposed

methods to form a film surface and ~~to~~ improve the scratch resistance, and it is not an object to improve the heat resistance, the thermal dimensional stability, and the mechanical properties of the film.

Kindly replace paragraph [0005] with the following:

It ~~is an object of the present invention to overcome the above-described problems and~~ would therefore be advantageous to provide a high-quality biaxially oriented thermoplastic resin film having excellent heat resistance, thermal dimensional stability, and mechanical properties. In particular, ~~the object is~~ it would be advantageous to provide a biaxially oriented thermoplastic resin film which significantly improves practical properties which have been taken seriously n various uses. Example of properties to be improved include the running durability in the magnetic recording medium use, the flatness and the warp during processing in the circuit material use, the heat resistance in the capacitor use, shift of printing in the ribbon use, and shift of a circuit in the card use.

Kindly replace paragraph [0006] with the following:

~~DISCLOSURE OF INVENTION~~ SUMMARY

~~Intensive research was conducted in order to achieve the above-described object. As a result, it was~~ We found ~~out~~ that when transition metal oxide particles were blended in a specific dispersion state, interaction between a thermoplastic resin and the particles was significantly enhanced, a cross-linking structure was formed between the molecular chain particles and, thereby, the storage modulus at a high temperature was improved, the melting point became higher, and industrially outstanding film was provided, which had excellent heat resistance, thermal dimensional stability, and mechanical properties and which was useful in various film uses. ~~Consequently, the present invention has been completed. That is,~~ The result was a

biaxially oriented thermoplastic resin film ~~of the present invention~~ is composed of a thermoplastic resin containing transition metal oxide particles, wherein the melting point of the biaxially oriented thermoplastic resin film is higher than the melting point of the thermoplastic resin to be used. A biaxially oriented thermoplastic resin film of the present invention is composed of a thermoplastic resin containing transition metal oxide aprticles, wherein the difference between a peak temperature (melting point T_1) of the heat of fusion in the first run of the measurement of the biaxially oriented film with a differential scanning calorimeter (DSC) and a peak temperature (melting point T_1) of the heat of fusion in the second run satisfies the following Formula (1).

$$2°C \leq T_1 - T_2 \leq 30°C \qquad (1)$$

Kindly replace paragraph [0008] with the following:

~~BEST MODE FOR CARRYING OUT THE INVENTION~~ DETAILED DESCRIPTION

A biaxially oriented thermoplastic resin film ~~of the present invention~~ is a film primarily containing a thermoplastic resin and transition metal oxide particles.

Kindly replace paragraph [0009] with the following:

The thermoplastic resin is not specifically limited, and may primarily contain at least one selected from the group consisting of a polyester, a polyphenylene sulfide, a polyolefin, a polyamide, a polyimide, a polycarbonate, a polyetheretherketone, a polysulfone, a polyethersulfone, a polyallylate, a vinyl chloride-based resin, a styrene-based resin, an acrylic resin, a polyacetal, a fluororesin, and the like. Preferably, the primary component constitutes at least 50 percent by weight, more preferably at least 70 percent by weight, and further preferably at least 90 percent by weight. ~~From the viewpoint of exerting the effect of the present invention,~~ ~~a~~ A polyester, a polyphenylene sulfide, a polyolefin, a polyamide, a polyimide, a polycarbonate,

and a polyetheretherketone are preferable interms of improvement of the heat resistance, the thermal dimensional stability, and the mechanical properties of the film. A polyester and polyphenylene sulfide are particularly preferable.

Kindly replace paragraph [0010] with the following:

The polyester is not specifically limited. However, preferably, the primary constituent is at least one structural unit selected from the group consisting of thylene terephthalate, ethylene-2, 6-naphthalate, hexamethylene terephthalate, cyclohexanedimethylene terephthalate, ethylene-a, B-bis (2-chlorophenoxy) ethane -4, 4'-dicarboxylate, butylene terephthalate, butylene-2, 6-naphthalate, and butylene-a, B-bis (2-chlorophenoxy) ethane-4, 4' – dicarboxylate units~~, because the effects of the present invention are exertedmore clearly~~. Preferably, the primary component constitutes at least 50 percent by weight, more preferably at least 70 percent by weight, and further preferably at least 90 percent by weight. With respect to the liquid crystal polyester resin, known liquid crystal polyesters described in, for example, U.S. Patent No. 4552948 may be sued. A liquid crystal polyester containing 40 to 90 percent by weight of parahydroxybenzoic acid (HBA) component as a primary mesogen and, in addition, containing 4, 5' – dihydroxybiphenyl (DHB) to improve the fluidity is preferable. The form of inclusion of the mesogen may be any form, e.g., random copolymerication, block copolymerization, branch copolymerization, and complex copolymerization of combination thereof. ~~In the present invention, a~~ A liquid crystal resin composed of, e.g., polyethylene terephthalate (PET) or polyethylene naphthalate (PEN)/HBA/DHB/isophthalic acid (IPA) or terephthalic acid (TPA), a copolymer primarily containing HBA/6-hydroxy-2-naphthoic acid, a copolymer of HBA/4,4'-dihydroxybiphenyl and terephthalic acid or isophthalic acid, a copolymer of HBA/hydroquinone (HQ)/sebacic acid (SA), and the like are preferable. Commercially available compounds may be used for them, and

Siveras produced by Toray Industries, Ltd., UENO-LCP produced by Ueno Fine chemicals Industry, Ltd., and the like may be used. ~~In the present invention, a~~ A polyester primarily containing polyethylene terephthalate (hereafter referred to as PET) and/or polyethylene naphthalate (hereafter referred to as PEN) is particularly prefereable in terms of the mechanical properties, the dimensional stability, and the productivity. Furthermore, a plurality of polymers may be blended ~~within the bounds of not hindering the objects of the present invention~~.

Kindly replace the second paragraph [0011] with the following:

~~In the present invention, a~~ A polyphenylene sulfide (PPS) resin refers to a resin containing at least 70 mole percent of poly-para(P)-phenylene sulfide. This is because if the content is less than the above-described value in the composition, properties, e.g., the heat resistance, the dimensional stability, and the mechanical properties, become poor. The above-described resin may contain a poly-meta(m)-phenylene sulfide polymer or small amounts, e.g., within the range of less than 30 mole percent, of other monomers having an aryl group, a biphenyl group, a terphenyl group, a vinylene group, a carbonate group, or the like copolymerized in any form.

Kindly replace paragraph [0015] with the following:

Preferably, the intrinsic viscosity of a polyester raw material ~~used in the present invention~~ is 0.55 to 2.0 dl/g, more preferably is 0.6 to 1.4 dl/g, and most preferably is 0.70 to 1.0 dl/g from the viewpoint of the stability in the film making process, the kneading property with particles, the decomposition property during melt extrusion, and the like.

Kindly replace paragraph [0017] with the following:

The transition metal oxide particles ~~in the present invention~~ are not specifically limited. However, oxide particles of V A group, VI A group, VII A group, VIII group, and I B group

transition metals in the periodic table of elements are preferable, and oxide particles of V A group, VI A group, VII A group, VIII group, and I B group transition metals of the fourth period in the periodic table of elements are more preferable. For example, particles of vanadium oxide, chromium oxide, manganese oxide, iron oxide, cobalt oxide, nickel oxide, copper oxide, niobium oxide, molybdenum oxide, technetium oxide, ruthenium oxide, rhodium oxide, palladium oxide, and silver oxide may be used. In the film ~~of the present invention,~~ manganese oxide, iron oxide, copper oxide, and the like are preferable, and copper oxide and yellow iron oxide of the fourth period in the periodic table of elements are most preferable from the viewpoint of the heat resistance, the thermal dimensional stability, the mechanical properties, and the stability of quality. Preferably, a primary component constituting the transition metal oxide particles is copper oxide. In this case, preferably, the content of copper oxide in the particle is at least 50 percent by weight, more preferably is at least 60 percent by weight, and further preferably is at least 70 percent by weight. When copper oxide particles are used, either cuprous oxide or cupric oxide may be used. However, cupric oxide is preferable from the viewpoint of the heat resistance, the thermal dimensional stability, the mechanical properties, and the stability of quality. Preferably, the weight fraction of cupric oxide in copper oxide is at least 50 percent by weight, more preferably is at least 60 percent by weight, and further preferably is at least 70 percent by weight. At least two types of particles may be contained in combination. The particles contained may be in the shape of any one of a sphere, a needle, and a plate, although not specifically limited. The shape of a sphere is preferable from the viewpoint of the smoothness of the film surface.

Kindly replace paragraph [0018] with the following:

Commercially available particles may be used for these transition metal oxide particles. For example, Nanotek produced by Nanophase Technologies Corporation may be used. More preferably, these particles are subjected to a surface treatment and, thereby, the ~~target~~ film ~~of the present invention~~ can be readily provided.

Kindly replace paragraph [0019] with the following:

Preferably, an average primary particle diameter of the transition metal oxide particles ~~of the present invention~~ is within the range of 3 to 120 nm. In order to control the average primary particle diameter of particles in the film ~~at~~ within the above-described range, addition to the resin may be performed by the use of transition metal oxide particles having an average primary particle diameter of 3 to 120 nm. Particles having an average primary particle diameter smaller than the above-described range are hardly available industrially. If larger than the above-described range, the film has poor stability in stretching and, therefore, the film tends to be broken during the film making process. Preferably, the average primary particle diameter is within the range of 5 to 100 nm, and most preferably is within the range of 10 to 50 nm.

Kindly replace paragraph [0020] with the following:

~~With respect to the film of the present invention,~~ ~~preferably~~ Preferably, an average secondary particle diameter of the transition metal oxide particles present in the film is within the range of 3 to 250 nm from the viewpoint of the heat resistance, the thermal dimensional stability, the mechanical properties, the stability in the film making process, and coarse protrusions on the film surface. In general, it is difficult to allow the average secondary particle diameter to become smaller than the above-described range. If larger than the above-described range, it must be noted that the stability in the film making process tends to become poor and, thereby, coarse

protrusions may be generated on the film surface, depending on applications, e.g., high-density magnetic tapes. More preferably, the average secondary particle diameter is within the range of 5 to 150 nm, and most preferably is within the range of 10 to 100 nm.

Kindly replace paragraph [0021] with the following:

~~In the present invention, preferably~~ Preferably, the content of the transition metal oxide particles in the thermoplastic resin film is 0.001 to 5 percent by weight from the viewpoint of the heat resistance, the thermal dimensional stability, and the mechanical properties of the film. More preferably, the content is 0.02 to 2 percent by weight, and most preferably is 0.1 to 1.5 percent by weight. If the content is smaller than the above-described range, the heat resistance, the thermal dimensional stability, and the mechanical properties of the film may not be adequately improved. If the content exceeds the above-described range, undesirably, aggregation of particles occur, Extrusion becomes unstable during making a film, and the film tends to be broken.

Kindly replace paragraph [0022] with the following:

If necessary, the transition metal oxide particles ~~used in the present invention~~ may be subjected to a particle surface treatment, e.g., a silane coupling treatment or a titanium coupling treatment, for the purpose of enhancing the affinity for a base resin and controlling the aggregation. The particle surface may be coated by an organic treatment. Inorganic particles, organic particles, and other various additives, for example, antioxidants, ultraviolet absorber, antistatic agents, crystallization nucleators, flame retardants, pigments, dyes, fatty esters, organic lubricants, e.g., wax, and inert particles, which are different from the transition metal oxide particles of the present invention, may be added within the bounds of not impairing the properties of the film. Specific examples of inorganic particles may include carbonates, e.g.,

calcium carbonate and barium carbonate; sulfates, e.g., calcium sulfates and barium sulfates: titanates, e.g., barium titanate and potassium titanate; and phosphates, e.g., calcium tertiary phosphate, calcium secondary phosphate, and calcium primary phosphate, although not limited to them. At least two of them may be used in accordance with purposes. Specific examples of organic particles may include vinyl-based particles, e.g., polystyrene or cross-linked polystyrene particles, styrene·acrylic and acrylic cross-linked particles, and styrene·methacrylic and methacrylic cross-linked particles; and particles of, e.g., benzoguanamine·formaldehyde, silicone, and polytetrafluoroethylene, although not limited to them. The particle diameters, the amounts of mixing, and the shapes of these particles can be selected in accordance with uses and purposes. In general, preferably, the average particle diameter is 0.01 μm or more and 3 μm or less, further preferably is 0.05 μm or more and 1 μm or less, and the amounts of mixing is 0.001 percent by weight or more and 5 percent by weight or less ~~from the viewpoint of the objects of the present invention as well~~.

Kindly replace paragraph [0023] with the following:

It is important that the melting point of the biaxially oriented thermoplastic resin film ~~of the present invention~~ is higher than the melting point of the thermoplastic resin to be used. Preferably, the melting point is at least 1° C. higher than the melting point of the thermoplastic resin to be used, and more preferably is at least 2° C. higher than that. The melting point of the biaxially oriented thermoplastic resin film may be measured as a peak temperature (melting point T_1) of the heat of fusion in the first run of the measurement with a differential scanning calorimeter (DSC). The melting point of the thermoplastic resin to be used may be measured as a peak temperature (melting point T_2) of the heat of fusion in the second run of the DSC measurement. ~~In the present invention it~~ It is important that the difference between the peak

temperature (melting point T_1) of the heat of fusion in the first run of the DSC measurement and the peak temperature (melting point T_2) of the heat of fusion in the second run of the measurement satisfies the following Formula (1),

$$2°C. \leq T_1 - T_2 \leq 30°C \qquad (1)$$

Kindly replace paragraph [0024] with the following:

~~more~~ More preferably the difference is within the range of 3° C. or more and 25° C. or less, and most preferably is within the range of 5° C. or more and 20° C. or less.

Kindly replace paragraph [0026] with the following:

With respect to the above-described Formula (1), when the difference between the melting points is at least 2° C., practical properties are adequately improved in all ~~uses~~ expected uses ~~in the present invention~~. It is industrially difficult to allow the difference between the melting points to become a value exceeding 30° C.

Kindly replace paragraph [0027] with the following:

~~In the present invention, with~~ With respect to the transition metal oxide particles present in the biaxially oriented thermoplastic resin film, preferably, the number of coarse aggregates of at least 3 μm is 30 per 100 cm_2 or less. Preferably, the number of coarse aggregates is 20 per 100 cm_2 or less, and more preferably is 10 per 100 cm_2 or less. If the number of coarse aggregates of at least 3 μm present in the film exceeds 30 per 100 cm_2, it must be noted that clogging of the filter may occur during extrusion for the film making process, and the stability in the film making process may be deteriorated due to frequent occurrences of breaking. Particularly, in the high-density magnetic recording use, if coarse aggregates are present, the electromagnetic conversion property and the error rate are significantly deteriorated, and it becomes difficult to provide a practically usable film.

Kindly replace paragraph [0029] with the following:

~~In the film of the present invention, preferably~~ Preferably, the area percentage of voids present in the biaxially oriented thermoplastic resin film is 0 percent or more and 5 percent or less, further preferably is 0 percent or more and 3 percent or less, and most preferably is 0 percent or more and 1 percent or less. If the void area percentage exceeds the above-described range, it must be noted that the mechanical properties, e.g., the Young's modulus and the elongation at break, of the film are deteriorated and the heat shrinkage is increased.

Kindly replace paragraph [0030] with the following:

In order to improve the heat resistance, the thermal dimensional stability, and the mechanical properties, the biaxially oriented thermoplastic resin film ~~of the present invention~~ must be a film stretched in the machine direction and in the transverse direction, that is, a biaxially stretched film (hereafter, the machine direction may be referred to as the longitudinal direction and the transverse direction may be referred to as the lateral direction). Examples of methods for stretching films include a simultaneous biaxial stretching method in which a longitudinal stretching and a lateral stretching are performed simultaneously, a sequential biaxial stretching method in which a longitudinal stretching and a lateral stretching are performed sequentially and, in addition, a so-called "longitudinal re-stretching" method in which a film sequentially stretched in two directions of longitudinal and lateral directions is stretched again in the longitudinal direction to enhance the strength in the longitudinal direction, a longitudinal re-stretching and lateral re-stretching method in which after the above-described longitudinal re-stretching is performed, the film is stretched again in the lateral direction to further enhance the strength in the lateral direction as well, and a multi-step longitudinal stretching method in which a film is stretched in a longitudinal direction in at least two steps and, subsequently, the film is

stretched in a lateral direction. Even when the film including particles according to the present invention is stretched, voids may be generated between the particles and a polymer serving as a base material. Consequently, it is preferable that a heat treatment or the like is performed at a temperature higher than or equal to the glass transition temperature Tg of the polymer in any step after the stretching in one direction is performed and, thereby, voids are reduced, although not limited to this.

Kindly replace paragraph [0031] with the following:

~~In the present invention, it~~ It is important that the plane orientation factor of the biaxially oriented polyester film is within the range of 0.120 or more and less than 0.280 from the viewpoint of improvement of the heat resistance, the thermal dimensional stability, and the mechanical properties. If the film is not provided with orientation and the plane orientation factor is smaller than the above-described range, a high Young's modulus may not be attained, and requirements may not be adequately satisfied in the magnetic recording film use. If the film is provided with excessive orientation and the plane orientation factor is larger than the above-described range, it must be noted that the elongation at break is reduced. In particular, when the polyester primarily contains ethylene terephthalate, preferably, the plane orientation factor is within the range of 0.165 or more and less than 0.200 in order to clearly exert the selected effects ~~of the present invention~~, more preferably is within the range of 0.175 or more and less than 0.190, and most preferably is within the range of 0.178 to 0.190. In particular, when the polyester primarily contains ethylene-2,6-naphthalate, more preferably, the plane orientation factor is within the range of 0.210 or more and less than 0.280 ~~in order to clearly exert the effects of the present invention,~~ and most preferably is within the range of 0.240 or more and less than 0.280.

Kindly replace paragraph [0032] with the following:

Preferably, the intrinsic viscosity (IV) of the biaxially oriented thermoplastic resin film ~~of the present invention~~ is 0.55 dl/g or more and 2.0 dl/g or less ~~from the~~ viewpoint of ~~the target properties of the present invention;~~ reduction of surface defects, foreign matters, ~~and~~ surface coarse protrusions~~;~~, and ~~the~~ stability in the film making process. Preferably, the intrinsic viscosity is within the range of 0.60 to 0.85 dl/g, and most preferably is within the range of 0.65 to 0.80 dl/g. If the intrinsic viscosity of the film is less than 0.55, film breaking tends to occur during the film making process and, thereby, it is difficult to form the film stably. If the intrinsic viscosity exceeds 2.0, it must be noted that the shear heat generation becomes large during the melt extrusion of the film, thermally decomposed.cndot.gelled materials are increased in the film and, thereby, a high-quality film is not readily provided.

Kindly replace paragraph [0033] with the following:

The thickness of the biaxially oriented thermoplastic resin film ~~of the present invention~~ may be appropriately determined in accordance with uses and purposes. However, the thickness is preferably within the range of 0.5 to 300 μm. More preferably, the thickness of the film is less than 150 μm ~~from the viewpoint of achieving the objects of the present invention,~~ and further preferably is less than 10 μm. Preferably, the thickness is within the range of 1 μm or more and 15 μm or less in the application to the magnetic recording material, is within the range of 2 μm or more and 10 μm or less in the application to the coating type magnetic recording medium for data, and is within the range of 3 μm or more and 9 μm or less in the application to the evaporation type magnetic recording medium for data. In general, the thickness of 10 to 300 μm is preferably adopted in the application to the circuit material. The thickness of 50 to 200 μm is more preferable, and 70 to 150 μm is further preferable. The film thickness of 0.5 to 15 μm is

preferably adopted in the application to the capacitor. This is because when the film thickness is within this range, the resulting film has excellent dielectric breakdown voltage and dielectric properties. Preferably, the film thickness is 1 to 6 μm in the application to the thermal transfer ribbon, and more preferably is 2 to 4 μm. This is because when the film thickness is within this range, no wrinkle is generated during printing, variations in printing and excessive transfer of ink do not occur and, therefore, high-precision printing can be performed. With respect to films used for plate making, magnetic recording cards, and IC cards, preferably, the film thickness is 30 to 150 μm, and more preferably is 70 to 125 μm.

Kindly replace paragraph [0034] with the following:

~~In the present invention, preferably~~ Preferably, variations in the thickness of the film in the machine direction are less than 15 percent from the viewpoint of broadening the range of application to various films and stability in the film making process. More preferably, variations in the thickness of the film are less than 10 percent, and further preferably are less than 8 percent, and most preferably are 6 percent or less.

Kindly replace paragraph [0035] with the following:

Preferably, the total of the Young's modulus in the machine direction and that in the transverse direction of the biaxially oriented thermoplastic resin film ~~of the present invention~~ is at least 9 GPa, preferably is at least 12 GPa in various applications to, for example, magnetic recording media, and preferably is 35 GPa or less from the viewpoint of the syability of the film making process. More preferably, the total is 14 GPa or more and 32 GPa or less, and most preferably is 15 GPa or more and 30 GPa or less.

Kindly replace paragraph [0037] with the following:

Preferably, the heat shrinkage at 100° C. in the machine direction and/or transverse direction of the biaxially oriented polyester film ~~of the present invention~~ is at least 0 percent in order to suppress occurrence of wrinkles due to thermal hysteresis during the processing step, and preferably is less than 1.0 percent in order to suppress track shift and the like of a magnetic tape. More preferably, the heat shrinkage is within the range of 0 to 0.8 percent, and most preferably is 0 to 0.5 percent. Preferably, the heat shrinkage at 150° C. in the machine direction and/or transverse direction of the film is 0 percent or more and less than 1.5 percent from the viewpoint of handling in various uses and improvement of the yield in the processing. More preferably, the heat shrinkage is within the range of 0 to 0.8 percent, and most preferably is 0 to 0.5 percent.

Kindly replace paragraph [0038] with the following:

~~In the present invention, it~~ It is a preferable condition that the storage modulus of the biaxially oriented polyester film ~~of the present invention~~ in the dynamic viscoelasticity measurement at 200° C. is 0.4 GPa or more and less than 3.0 GPa. More preferably, the storage modulus is 0.6 to 2.0 GPa, and most preferably is 0.8 to 1.5 GPa. If the storage modulus in the dynamic viscoelasticity measurement at 200° C. is less than 0.4 GPa, the thermal dimensional stability at a high temperature and the flatness in the processing are deteriorated. If the storage modulus exceeds 3.0 GPa, it must be noted that in many cases, the melt extrusion is not readily performed and the stability in the film making process is deteriorated. The storage modulus is a value measured with DMS6100 produced by Seiko Instruments Inc., at a frequency of 1 Hz in the dynamic viscoelasticity measurement in which temperature is raised from 26° C. to 240° C. at a temperature rise rate of 2° C./min.

Kindly replace paragraph [0039] with the following:

The film ~~of the present invention~~ may be a laminated film composed of at least two layers. In particular, the laminated film in which at least two layers are laminated is suitable for the use in a method for designing a film surface serving as a magnetic recording surface and a running surface opposite thereto to have different surface roughness in accordance with uses of base films of magnetic recording media.

Kindly replace paragraph [0040] with the following:

With respect to a method for manufacturing a film ~~according to the present invention~~, a specific example of the method for manufacturing a biaxially oriented thermoplastic resin film will be described with reference to the case of a polyester. However, ~~the present invention~~ this disclosure is not limited ~~to this~~.

Kindly replace paragraph [0041] with the following:

A polyester resin ~~used in the present invention~~ may be manufactured by a previously known method. Transition oxide particles to be added to a predetermined polyester resin may be added in any stage before polymerization, during polymerization, or after polymerization in the resin manufacturing process. However, in order to satisfy the range of coarse aggregates ~~specified in the present invention~~, for example, in the case of PET or PEN, (a) a method in which the particles in the form of slurry are kneaded with the polymer by the use of a vent type twin screw kneading extruder and (b) a method in which the particles are added to ethylene glycol and the like, which is a diol component used as the material, by mixing and dispersing in the form of slurry are adopted preferably. ~~In the present invention, a~~ A method in which a slurry containing dispersed particles is added to a twin screw kneading extruder and, thereby, is kneaded with a polymer is most preferable. Preferably, the LID of the twin screw kneading extruder used is at

least 25, and more preferably is at least 30. Preferably, the residence time of the polyester -resin is 10 seconds or more and 90 seconds or less, more preferably is 20 seconds or more and 80 seconds or less, and further preferably is 30 seconds or more and 70 seconds or less. At this time, ~~in order~~ to prevent aggregation of the particles, a surface treating agent of the particle may be used by a known method in accordance with the type of the polyester resin. Examples of usable surface treating agents include anionic surfactants, e.g., sodium dodecylbenzenesulfonate, lithium dodecylbenzenesulfonate, sodium lauryl sulfate, sodium dialkylsulfosuccinate, and naphthalenesulfonic acid formalin condensate salt; nonionic surfactant, e.g., polyoxyphenol ether, polyethylene glycol monostearate, and stearic acid monostearate, and metal salts thereof; water-soluble synthetic polymers, e.g., polyvinyl alcohol, polyvinyl pyrrolidone, and polyethylene glycol; water-soluble natural polymers, e.g., gelatin and starch; water-soluble semisynthetic polymers, e.g., carboxymethyl cellulose; silane-based and titanium-based coupling agents; and phosphoric acid compounds, e.g., phosphoric acid, phosphorous acid, phosphonic acid, and derivatives thereof. With respect to a method for physically mixing these surface treating agents, a grinder, e.g., a roll mill, a high-speed rotary grinder, or a jet mill: or a mixer, e.g., a Nauta mixer, a ribbon mixer, or a Henschel mixer, may be used. A media dispersion method in which glass beads are used as media is particularly effective as a method for dispersing particles ~~of the present invention~~ in a slurry. Preferably, glass beads to be used have diameters of 10 to 300 μm, more preferably of 30 to 200 μm, and the diameter of 50 to 100 μm is most preferable from the viewpoint of the dispersion property of the particles. Preferably, the agitation speed is 2,000 to 8,000 rpm, more preferably is 3,000 to 7,000 rpm, and 4,000 to 6,000 rpm is most preferable. Preferably, the agitation time is 1 to 9 hours, more preferably is 3 to 7 hours, and most preferably is 4 to 6 hours. Preferably, the media are mixed with the same volume

of slurry to be used and are dispersed. The slurry may be a water slurry, an ethylene glycol slurry, or the like, which may be appropriately selected in accordance with the types of polymer and particles to be used. Most preferably, a surface treating agent is added to the slurry to disperse the media at this time ~~in the present invention~~. After the media are dispersed, preferably, filtration is performed with a 5 μm cut filter, preferably with a 3 μm cut filter, and most preferably with a 1 μm cut filter. The cut filter to be used is not specifically limited, and may be appropriately selected in accordance with the particles to be used.

Kindly replace paragraph [0042] with the following:

Preferably, the chlorine content of the transition metal oxide particles ~~used in the present invention~~ is reduced before addition to the resin by, for example, a method in which cleaning is performed with hot water and, subsequently, drying is performed under a reduced pressure.

Kindly replace paragraph [0044] with the following:

The resulting polyester resin pellets containing these particles are adequately dried, if necessary, and thereafter, are fed into an extruder heated to a temperature higher than or equal to the melting point of the polyester resin in a nitrogen stream or under a reduced pressure in order that the inherent viscosity is not decreased. Preferably, the screw shear rate ($=\pi DN/(60)h$); D: screw diameter (cm), N: screw rotational speed (rpm), h: groove depth (cm) of screw metering zone) of the extruder to be used is 50 to 1,000 sec^{-1}, more preferably is 90 to 500 sec^{-1}. Further preferably, the screw shear rate is 150 to 300 sec^{-1} from the viewpoint or prevention of the thermal decomposition of the thermoplastic resin and the dispersibility of the thermoplastic resin and the particles. The screw used for melt extrusion may be a screw in any shape, such as of a full-flighted type or a barrier-flighted type. However, it is preferable that various mixing type screws having the ratio (L/D) of the length (L) to the diameter (D) of the screw of at least 20,

preferably of at least 25 are used from the viewpoint of enhancement of the particle dispersibility of the thermoplastic resin and particles and reduction of coarse aggregates. The mixing type screw refers to a screw having a mixing zone at a position in the screw compression zone, in the screw metering zone, or at the midpoint therebetween, and may be a screw having a fluted barrier, Dulmage, Unimelt, multiple pin, or the like. The extruder may be either of a single screw type or a twin screw kneading type, and it is effective to use a high-shear·low-heat type screw. In the case of a single screw type, a tandem extruder may also be used preferably. The polymer discharge time is preferably controlled at 90 seconds or more and 6 minutes or less, and more preferably is 2 minutes or more and 4 minutes or less. Subsequently, the melted polymer is extruded from a nozzle, and is cooled on a casting drum having a surface temperature lower than or equal to the glass transition temperature of the polyester resin, so that an unstretched film is prepared. In order to remove foreign ~~matters~~ matter and deteriorated polymers in melt extruders, preferably, various filters, for example, filters composed of sintered metal, porous ceramic, sand, wire mesh, or other materials are used. Preferably, the filtration accuracy of the filter is appropriately selected in accordance with transition metal oxide particles to be used and particle diameters of inert particles.

Kindly replace paragraph [0047] with the following:

For example when the sequential biaxial stretching is used ~~in the present invention~~, the condition of the stretching in the machine direction is not specifically limited. However, preferably, the stretching speed is 10,000 to 150,000 percent/min, the stretching temperature is within the range of the glass transition temperature Tg of the polyester resin or higher and (the glass transition temperature+50° C.) or lower. Preferably, the stretching ratio is within the range

of 2.5 to 10 times, further preferably is 3.0 to 5 times. ~~In the present invention, a~~ A uniaxially oriented film is prepared by the stretching in the machine direction as described above.

Kindly replace paragraph [0048] with the following:

~~Here, since~~ Since voids may tend to occur depending on, for example, the combination of the polyester resin and the transition metal oxide particles, preferably, the uniaxially oriented film prepared by the above-described method is heat-treated at the inlet of the tenter at the melting point Tm of the polyester resin or lower and the glass transition temperature Tg or higher in order to reduce the amount of voids in the film. More preferable heat treatment temperature is (the glass transition temperature Tg+20° C.) or higher and (the melting point Tm-100° C.) or lower.

Kindly replace paragraph [0053] with the following:

The biaxially oriented thermoplastic resin film ~~of the present invention~~ may be preferably used for magnetic recording media, circuit materials, capacitors, thermal transfer ribbons, and cards. With respect to magnetic recording media, the film may be preferably used for high-density magnetic recording media, e.g., digital videos and data storage tapes, although not limited to them. With respect to circuit materials, the film may be used for circuit boards, e.g., flexible printed circuit boards (FPC) having electric circuits on at least one surface of a biaxially oriented thermoplastic resin film, multilayer circuit boards, build-up circuit boards, and films used for semiconductor package (TAB), and for circuit board protection films, e.g., coverlay. With respect to capacitor uses, capacitors may be of any type, e.g., with a lead or with no lead (so-called chip capacitor), although not limited to them. With respect to thermal transfer ribbons, the film is used for any transfer system, e.g., a thermal ink transfer system or a thermal sublimation transfer system. In the case of the thermal sublimation system, a base film is

required to have high heat resistance and, therefore, the biaxially oriented thermoplastic resin film of the present invention is used preferably. With respect to cards, the film can be applied to cards capable of recording information, in particular, cards capable of magnetically, electrically, or optically reading and/or writing; and/or cards capable of recording information by embossing. Specifically, the film is suitable for magnetic cards, e.g., contact type IC cards, non-contact type IC cards wherein IC chips and antenna circuits are embedded in the cards, and magnetic stripe cards; optical cards; and the like. More specific examples of cards may include prepaid cards, credit cards, banking cards, various identification cards, and driver's license cards.

Kindly replace paragraph [0055] with the following:

Methods for measuring characteristic values ~~used in the present invention~~ and methods for evaluating effects will be described below.

Kindly replace paragraph [0089] with the following:

A surface of the film ~~of the present invention~~ is doubly coated with a magnetic coating material and non-magnetic coating material having the following respective compositions with an extrusion coater (an upper layer is the magnetic coating material having a coating thickness of 0.1 μm, and the thickness of the non-magnetic lower layer is appropriately changed), and magnetic orientation and drying are performed. Subsequently, a back coat layer having the following composition is formed on the other surface, a calendering treatment is performed with a small test calender (steel/steel rolls, 5 stages) at a temperature: 85° C. and a linear pressure: 200 kg/cm, and curing is performed at 70° C. for 48 hours. The above-described film to be used for tapes is alit into 8 mm width and, therefore, a pancake is prepared. A 200 m length of the resulting pancake is incorporated into a cassette, so that a cassette tape is prepared.

Kindly replace paragraph [0096] with the following:

A surface of the film ~~of the present invention~~ is coated with a magnetic coating material having the following composition in order that the coating thickness becomes 2.0 μm, and magnetic orientation and drying are performed. Subsequently, a back coat layer having the following composition is formed on the other surface, a calendering treatment is performed, and curing is performed at 70° C. for 48 hours. The above-described film to be used for tapes is slit into ½ inch width, a 670 m length of the film is incorporated as a magnetic tape into a cassette, so that a cassette tape is prepared.

Kindly replace paragraph [0139] with the following:

EXAMPLES

The ~~present invention~~ films will be described with respect to examples.

Kindly replace paragraph [0182] with the following:

~~According to the present invention, a~~ A biaxially oriented thermoplastic resin film having excellent heat resistance, thermal dimensional stability, and mechanical properties can be provided. Therefore, the biaxially oriented thermoplastic resin film ~~of the present invention~~ can be widely used as films for various industrial materials, for example, magnetic recording media, circuit materials, capacitors, thermal transfer ribbons, and cards.